

Claims 1-16. (Canceled)

17. (Original) An acoustic signal generator for generating an acoustic signal with a high amplitude, sudden onset, comprising:

a main cylinder having front and rear opposed ends and an axial opening in each end;

a partition in an intermediate portion of said cylinder dividing said cylinder into front and rear chambers, and an axial opening in said partition communicating between said chambers;

a rear cylinder attached to said rear cylinder end around said rear axial opening and communicating therethrough with said rear chamber;

a piston assembly having an intermediate piston in said rear chamber, and a rear piston in said rear cylinder;

a seal assembly connected to said piston assembly and movable therewith, said seal assembly having a front plug and a front seal coacting with said front plug to seal said front end axial opening, and an intermediate seal plugging said axial opening in said partition;

said front seal is mounted on said front plug and is normally disposed on said front plug in a bore forming part of said front axial opening and is movable axially with said front plug;

a pneumatic operating system for charging said rear chamber of said main cylinder with gas at a first high pressure and for charging said rear cylinder with gas at a second high pressure, said pneumatic operating system including a coupling for connection to a source of gas pressure and a remotely operated vent to allow said pressurized gas in said rear cylinder to escape, thereby reducing forwardly directed forces on said intermediate piston in said rear chamber exerted by pressurized gas on said rear piston, below rearwardly directed forces exerted by pressurized gas in said forward chamber against said intermediate seal.

18. (Original) An acoustic signal generator as defined in claim 17, wherein:

said vent includes a restricted orifice through which gas is allowed to escape from said rear cylinder at a preselected slow rate;

whereby a gas cushion remains in said rear cylinder to decelerate said piston assembly and minimize damage to said piston assembly.

19. (Currently Amended) An acoustic signal generator as defined in claim ~~19~~ 17, wherein:

said front seal is of smaller diameter than said intermediate seal.

20. (Original) A method of generating an acoustic signal having a sharp, high amplitude onset, comprising:

plugging an opening into a cavity within a body by positioning a plug in said opening, said opening communicating through said body between said cavity and external space outside said cavity;

pressurizing gas in said cavity;

accelerating said plug to high speed prior to unplugging said opening; and

unplugging said opening by moving said valve at high speed from a fully plugged position to a fully unplugged position and releasing said pressurized gas suddenly from said cavity to said external space.

21. (Original) A method as defined in claim 20, wherein said valve accelerating step comprises:

opening a port between said cavity; and

exerting elevated gas pressure suddenly against a large diameter piston connected to said valve.

22. (Original) A process of determining the arrival time of an acoustic signal propagated through a noisy environment and detected in a receiver, comprising:

digitally pre-filtering said acoustic signals received in said receiver to facilitate differentiation between background noise in said open space and said acoustic signal so as to locate the beginning of said acoustic signal in said background noise; said prefiltering includes, a) measuring N consecutive samples of said signal received in said receiver, b) predicting what an N+1th signal will be from the previous N samples, c)

measuring said $N+1^{\text{th}}$ sample to obtain an actual measured value of said $N+1^{\text{th}}$ sample, d) subtracting said predicted $N+1^{\text{th}}$ signal from said actual measured $N+1^{\text{th}}$ signal value; and,
e) repeating steps a)-d) with each new sample taken to produce a small amplitude modified signal having more characteristics of said acoustic signal from said signal generator;

forming a stochastic model having two or more states, each state behaving like a stationary random variable that produces uncorrelated white Gaussian noise, said model able to move from state to state as time progresses, said model having a first state representing said background noise of said filtered signal without said acoustic signal imposed, and a second state acting like said acoustic signal; normalizing said filtered signal to zero-mean as part of said pre-filtering process; estimating the statistical variance of the samples from said first state using signal samples known to contain only background noise with said acoustic signal absent, using samples that occur before generation of said acoustic signal by said acoustic signal generator; estimating the statistical variance of samples from said second state from samples located directly around said sample with maximum amplitude in the filtered signal; and determining the most probable time for the shift from said first state to said second state, and the most probable time for the arrival of said acoustic signal, by labeling each time index with a state using said filtered signal from said receiver and said stochastic.

23. (Original) A method of centering a fireball in a boiler furnace, comprising:
separately actuating in rapid succession two signal generators placed in opposite sides of a fire box, and receiving signal produced by said signal generators in two receivers positioned opposite each other and on a plane transverse to a plane through both said signal generators;
analyzing signals received in said receivers to detect non-uniform temperatures along sides of said firebox;
adjusting the orientation of burners in said firebox to shift the fireball toward the center of the firebox.